इंटरनेट मानक

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Jawaharlal Nehru
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IS 10988 (1984): Method of measuring noise from machine tools (excluding testing in anechoic chambers) [PGD 3: Machine Tools]

Act Number 22 of 2005
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Bhartṛhari—Nītiśatakam
“Knowledge is such a treasure which cannot be stolen”

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UDC 621·9 : 534·83·08 : 534·61

IS : 10988 - 1984

(Reaffirmed 2005)

Indian Standard

METHOD OF MEASURING NOISE FROM MACHINE TOOLS (EXCLUDING TESTING IN ANECHOIC CHAMBERS)

1. Scope — Relates to the procedure to be followed in carrying out noise measurements of machine tools.

1.1 It deals with general conditions, such as room suitability, background noise, etc, and the measuring processes, such as instrumentation, measuring points and units of measurement, and a standard proforma for the statement of results.

Note — This standard recommends the measurement of continuous noise by conventional instruments.

2. Terminology

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 *Sound Pressure Level* — Sound pressure level of a sound or noise at a point in a sound field, is defined as:

$$20 \log \frac{P}{P_0} \text{ decibels (dB)}$$

where

P = measured sound pressure in N/mm^2, and
P_0 = reference sound pressure of 2×10^{-5} N/m^2 (2×10^{-4} dyne/cm^2).

2.2 *Sound Level* — The reading given by a sound level meter shall comply with relevant Indian Standard (*see* IS : 9779-1981 'Sound level meters').

2.3 *Prescribed Path* — A path surrounding the machine tool over which the measurements have to be made.

2.4 *Machine Tool* — A power driven machine, not portable by hand when working, intended to be used for working metal, wood, plastics and other materials by the removal of chips or swarf or by erosion, chipless formation or physico-chemical processing or combination of some of these techniques.

3. Test Conditions

3.1 *General*

3.1.1 The machine shall be tested with all the ancillary equipments essential for its operation, for example, hydraulics, power-supplies, frequency converters, bar feeds, etc.

If such equipments are remote from the machine, it shall be tested separately.

Allowance shall be made for running the machine up from cold to normal conditions.

3.2 *Specific Room Suitability*

3.2.1 The suitability of a room for testing machine tools may be determined by placing a small broad band random noise source with omnidirectional characteristics in the centre of the room and determining the sound level at the selected measuring points, either in dB (A) or dB in each octave band as specified in **4.3** and at corresponding points twice their distance from the source.

Note — If the outer measuring points are less than 3 m from a reflecting surface, the desired drop in sound level may not be obtained.

Machine Tools, Machine Tool Elements and Woodworking Machines Sectional Committee, EDC 11; Machine Tools-Basics Subcommittee, EDC 11 : 14 [Doc : EDC 11 (3885)]

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3.2.2 The drop in average sound pressure level, determined as in Appendix B, between the inner and outer measuring points shall be 5 dB minimum. Sufficient measurements shall be taken to establish the maximum distance that the inner measuring points can be from the reference source whilst still enabling this difference in readings to be achieved; this will indicate the maximum size of machine that can be tested in the room. In case the required 5 dB differences in level cannot be achieved, the room may be used for machine noise measurements of a lower order of accuracy provided that the variations from 5 dB are stated separately.

Note — The data obtained by a test conforming to this standard shall therefore be interpreted with a proper degree of caution especially when a machine tool may be placed in an accoustical environment different from that in which it was tested, for instance, placing a machine tool in a smaller room having boundary surfaces more reflective of sound which will tend to increase the noise levels during repeated measurements.

3.2.3 The machine shall be tested in the unloaded condition and preferably also in the loaded condition but the resultant values shall not be quoted without stating the condition in which the machine was tested and if in the loaded condition, loading conditions shall be mentioned.

Note 1 — The machine shall be in its noisiest operating condition; that is if there are high and low ranges of speed in the machine, the noise levels shall preferably be taken at the highest speed in both the ranges.

Note 2 — Loaded conditions can easily be defined for special purpose machines as the job, cutting conditions, etc, are more or less fixed. But it is difficult to define ' loaded condition ' for general purpose machines as the loading of the machine and the noise level may vary considerably depending upon the job, cutting conditions, etc. Loaded condition in such cases have to be arrived at an agreement between the purchaser and the manufacturer.

3.2.4 For presentation of results in accordance with Appendix D supported by Appendix C the measurement in dB(A) and octave bends shall be averaged in accordance with procedure given in Appendix B and included on the test record sheet.

3.3 *Site Testing* — The machines which are too large for the room under consideration to meet the room suitability criteria, these shall be tested under site conditions. In this case, the machine itself may be used as reference source and the doubling of distance shall be related to the geometric centre or to the major noise source of the machine.

3.4 *Background Noise*

3.4.1 The background noise level when the machine is not on test, expressed in either dB(A) or octave bands, as specified in **4.3** shall be determined at each measuring position. The readings with the machine running shall be taken at the same points and under the same conditions and the background noise level shall be less by at least 10 dB(A) or 10 dB as the case may be.

3.4.2 When the differences are less than 10 dB, corrections as given below shall be applied:

Increase in Level to Nearest dB Produced by the Machine dB	Amount to be Subtracted From the Measured Value dB
3	3
4 - 5	2
6 - 9	1

3.4.3 If the difference between measured sound and background noise is less than 3 dB, a valid measurement cannot be obtained.

3.4.4 Noise measurement and the coressponding background noise shall be recorded at each measuring point and corrected values shall be recorded wherever corrections are applicable.

In ideal condition, the background noise level shall remain constant during the period of test. However, if any changes in the background noise level do occur, then these changes shall be noted so that the appropriate corrections can be made to the total noise avoiding externally caused transient disturbances.

3.5 *Mounting Conditions* — The machine shall be mounted in accordance with the manufacturer's instructions. Mounting conditions, that is, type of floor, anti-vibration mounting, etc, shall be recorded.

4. Measurements

4.1 *Measuring Points*

4.1.1 *Prescribed path positions* — The prescribed path shall be taken as 1 m from the vertical projected plan of the machine at a height of 1·5 m, ignoring small projections caused by elements like handwheels, stop bars, etc. In case of machine tools whose operations necessitate or permit a change in the projected plan due to, for example, a trevelling table, the prescribed path shall be drawn 1 m from the extremities of the change in the projection plan.

Microphone positions should be at horizontal separations of not more than 1·5 m along the prescribed path around the machine. The number of measuring points on the path shall not be less than 5 and shall include the point at which the sound level in dB(A) is the highest.

4.1.2 *Other positions* — In addition to above (*see* **4.1.1**), measurements shall be taken at the operating position and all other positions that may be occupied by personnel for a significant proportion of their working day. Such measurements shall be reported separately and excluded from the calculations of mean sound levels.

4.1.3 Typical measuring positions for representative types of machine tools have been given in Fig. 1 to 3 of Appendix A.

4.2 *Measuring Instruments*

4.2.1 *Type of instrument* — The instruments used for making measurements for the purpose of the test specified in this standard shall be sound level meter in accordance with IS : 9779-1981 or octave band filters in accordance with IS : 6964-1973 ' Octave, half-octave and third-octave band filters for analysis of sound and vibrations ', or any other suitable instruments.

4.2.2 The measuring instruments shall be used strictly in accordance with manufacturer's instruction and shall be calibrated against acoustics standards at suitable intervals.

4.2.3 *Mounting of instruments* — The microphone shall be at least 0·3 m from the case of the instrument and approximately 1 m from the observer.

4.3 *Type of Measurement*

4.3.1 The measurements are expressed as sound levels in dB(A) and as band pressure levels in dB for octave bands having centre frequencies from 63 Hz to 8000 Hz.

4.3.2 At each measuring point the sound level shall be measured in dB(A). At the operating positions octave band analysis shall be employed and this shall also be used at the location giving the highest sound level reading in dB(A) and three other points uniformly spaced around the machine tool on the prescribed path.

5. Variation of Noise with Time — At each measuring point a visual average and miximum reading shall be taken, using the slow setting of instruments for all readings.

The measurements at each point shall be taken over a period of time, including the normal operating cycle if appropriate.

6. Presentation of Results

6.1 *Calculation of Mean Levels* — The octave band mean levels and mean sound levels shall be calculated in accordance with the formulae given in Appendix B.

6.2 *Recording and Presentation of Results*

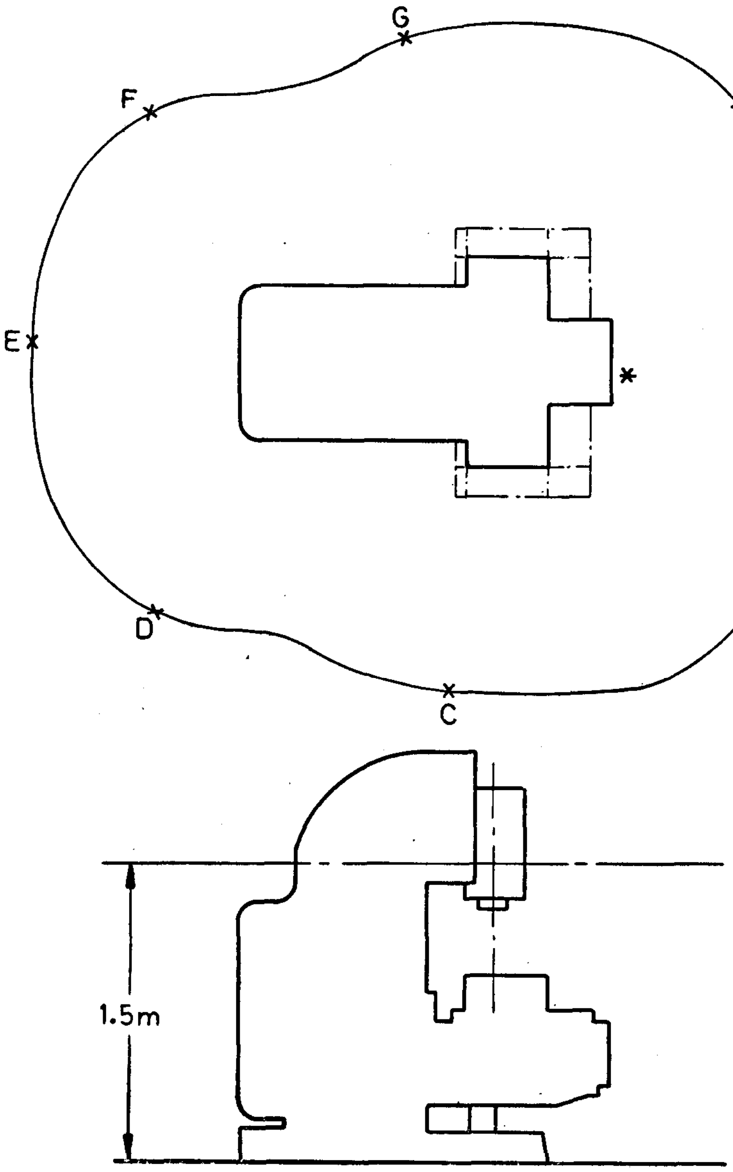
6.2.1 *Test record sheet* — The test results shall be given on test record proforma. A recommended layout for such proforma is given in Appendix C.

6.2.2 *Test report* — The presentation of results of a noise test shall include at least those items listed in Appendix D supported by Appendix C.

APPENDIX A

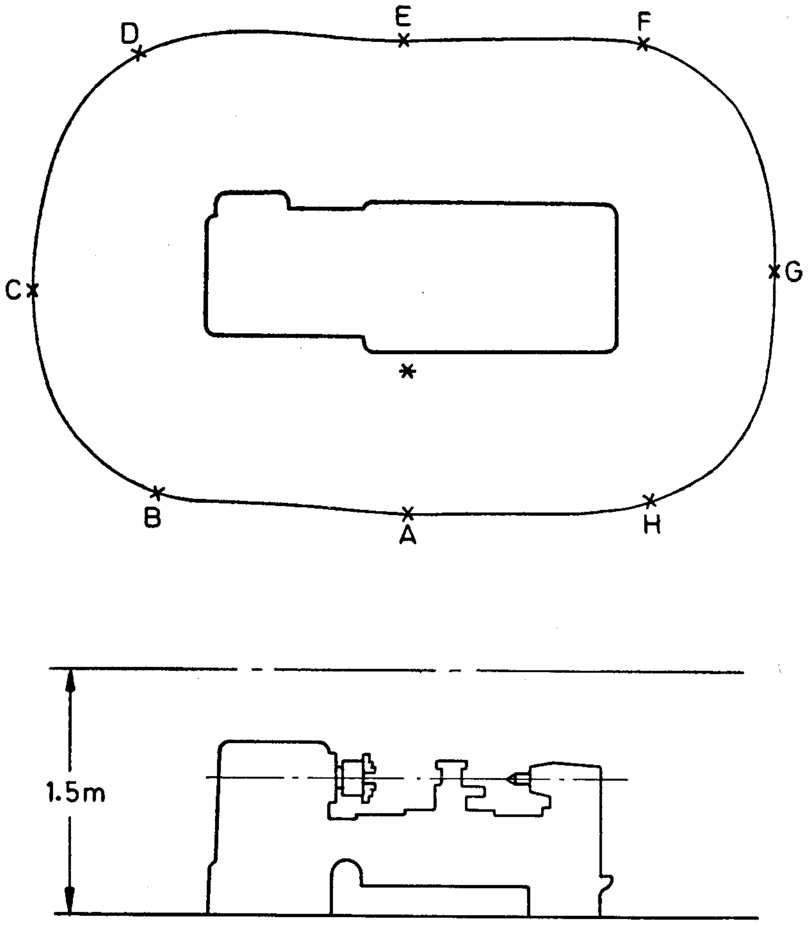
(*Clause* 4.1.3)

TYPICAL MEASURING POSITIONS AROUND THE MACHINES



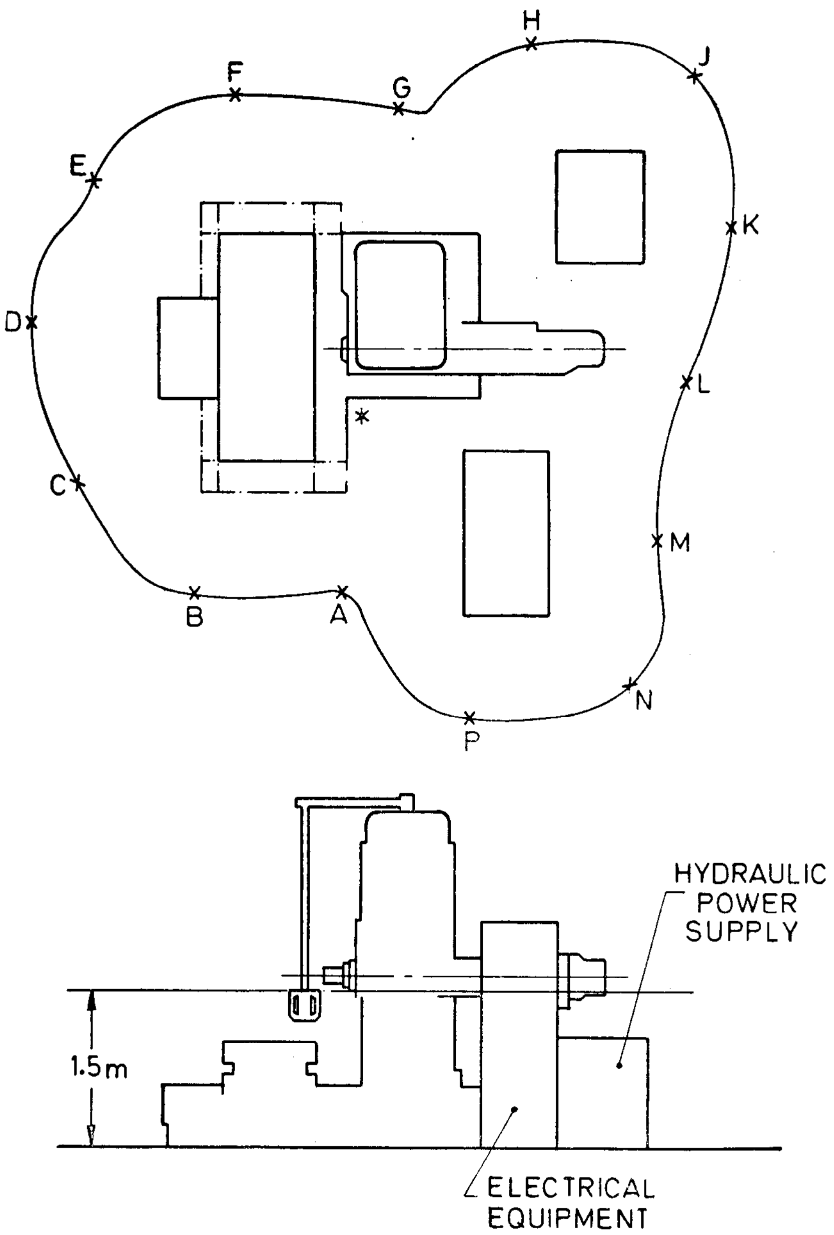
*is the nearest point in the line with the operator's position.

FIG. 1 TYPICAL MEASURING POSITIONS AROUND VERTICAL MILLING MACHINE



*is the nearest point in the line with the operator's position.

FIG. 2 TYPICAL MEASURING POSITIONS AROUND CENTRE LATHE HAVING 350 mm DIAMETER SWING



*is the nearest point in the line with operator's position.

FIG. 3 TYPICAL MEASURING POSITIONS AROUND NUMERICALLY CONTROLLED BORING MACHINE

APPENDIX B

(*Clauses* 3.2.2 *and* 6.1)

CALCULATION OF LEVELS

B-1. Octave Band Mean Levels — The octave band mean level shall be calculated from the measurements at all test points (after correction for background sound levels) by averaging in accordance with the following equation:

$$L = 10 \log_{10} \frac{1}{n} \left[\text{antilog}_{10} \frac{L_1}{10} + \text{antilog}_{10} \frac{L_2}{10} + \ldots\ldots\ldots\ldots\ldots\ldots \text{antilog}_{10} \frac{L_n}{10} \right]$$

where

L = octave band sound pressure (dB);
L_1 = octave band sound pressure level at first measuring point;
L_n = octave band sound pressure level at nth measuring point; and
n = number of measuring points.

B-2. Mean Sound Levels in dB(A) — The mean sound level [dB(A)] shall be calculated from the measurements at all the test points (after correction for background sound levels) by averaging in accordance with the following equation:

$$L_A = 10 \log_{10} \frac{1}{n} \left[\text{antilog}_{10} \frac{L_{A1}}{10} + \text{antilog}_{10} \frac{L_{A2}}{10} + \ldots\ldots \text{antilog}_{10} \frac{L_{An}}{10} \right]$$

where

L_A = mean sound level [dB(A)],

L_{A1} = sound level [dB(A)] at first measuring point,

L_{An} = sound level [dB(A)] at *n*th measuring point, and

n = number of measuring points.

APPENDIX C

(*Clauses* 3.2.4, 6.2.1 *and* 6.2.2)

PROFORMA FOR THE TEST RESULTS RECORD

Machine tool noise test record sheet………………

Test conducted in accordance with IS : …………

Testing organization……………………………………

Date of test……………………………………………

Instrumentation ……………………………………

……………………………………………………………

……………………………………………………………

Sheet no……………………………… (use sheets No. 1, 2 and 3 to record room suitability background and machine noise tests, respectively*)

Machine tested ……………………………………

Serial No. or reference……………………………

Permissible noise level……………………………

State of machine (speed, mounting conditions, etc. Unusual ambient temperature conditions shall be noted).

……………………………………………………………

……………………………………………………………

……………………………………………………………

Unloaded : Yes/No

Loaded : Yes/No

How loaded…………………………………………

……

……

Description of test site…………………………………………………………………………………………

Pre-test instrument calibration result………………………………………………………………………

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*Complete as applicable.

Position No.	Room Suitability (Measurement Path)	Background	Machine Noise	dB(A)	Octave Band Centre Frequency (Hz)								
					63	125	250	500	1 k	2 k	4 k	8 k	
1	inner (1m) outer (2m)	—	visual average peak										
2	inner (1m) outer (2m)	—	visual average peak										
3	inner (1m) outer (2m)	—	visual average peak										
4	inner (1m) outer (2m)	—	visual average peak										
5	inner (1m) outer (2m)	—	visual average peak										
6	inner (1m) outer (2m)	—	visual average peak										
Mean levels	inner (1m) outer (2m)	—	visual average peak										
Difference		—	—										
Correction due to background													
Corrected mean levels			Visual average										

Post-test instrument calibration result..

Draw plan on grid overleaf and show location of measuring positions.

Signed...

Draw plan of room (for room suitability and background tests) or of machine, including any ancillary equipment (for machine noise test), and show dimensions to measuring positions.

APPENDIX D

(*Clauses* 3.2.4 *and* 6.2.2)

MACHINE TOOL NOISE TEST REPORT

A minimum presentation of results of a noise test performed in accordance with this standard shall state:

a) That the room was shown to be suitable for the particular test by the specified procedure,

or

That the room suitability test indicated that the following average level differences between inner and outer measuring position were obtained.

dB(A)	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1 k	2 k	4 k	8 k

b) That the background noise was tested and found to be 10 dB or more below machine noise levels,

or

That the specified corrections to machine noise levels have been made in consequence of background noise.

c) Machine mounting conditions, if other than a solid floor.

d) Mean levels of machine noise (corrected as necessary) in dB(A) :
    1) visual average, and
    2) peak.

e) Machine noise levels in dB(A) and eight octave frequency bands:
    1) at operator's position, and
    2) other working positions.

f) Permissible noise level.

g) A reference to this standard, that is, IS : 10988.

EXPLANATORY NOTE

This standard is generally [redacted] based on BS 4813 : 1972 ' Method of measuring noise from machine tools excluding testing in anechoic chambers ', issued by the British Standards Institution.

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